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ON THE CLASSIFICATION OF THE RECENT AND FOSSIL FISHES. — Professor Cope has recently reviewed the structure of the fossil fishes, and proposed a number of necessary modifications of the system as left by Agassiz in the *Poissons Fossiles.* He has confirmed the views of various naturalists, that the class or sub-class *Ganoidea* of that author consists of heterogeneous materials, which must be distributed in a number of sub-classes. He recognizes four sub-classes of *Pisces:* namely, the *Holocephali*, the *Dipnoi*, the *Selachii*, and the *Hyopomata.* The last named is proposed for that natural assemblage which possess a hyo-mandibular bone articulated with the cranium, a maxillary arch, and no median axis of the basal portion of either pectoral or ventral fins. Under this group he arranges three tribes, namely, the *Crossopterygia* (or *Ganoidea*), the *Chondrostei*, and the *Actinopteri;* the last made up of the *Teleostei* of Müller, and a few recent, and many extinct fishes referred by Agassiz and Müller to the "Ganoidei." Professor Cope shows that Huxley's "suborder *Crossopterygia*," is also a heterogeneous assemblage, many of the forms referred to it belonging to the *Dipnoi*, while others are true *Hyopomata.*

The fossil fishes referred to the *Actinopteri* were found to be most nearly related to the order *Isospondyli;* none of them presenting near affinities to *Lepidosteus*, so far as discoverable. An exception to this statement, is the genus *Dorypterus*, which was regarded as typical of a new order presenting some relationship to Acanthopterygian orders. The order was named the *Docopteri.* The fossil families referred to the *Isospondyli*, are the *Sauropsidæ* (*Sauroidei* Agass. pt.), *Lepidotidæ* (*Lepidoides* Agass. pt.), *Pycnodontidæ* (*Pycnodontes* Agass. pt.), and *Dupediidæ* (*Lepidoides* Agass. pt.)

MICROSCOPY.

THE NEW MODEL ILLUMINATING ADJUSTMENT. — The plan of mounting the diaphragm, substage, and mirror upon a bar so hinged that they shall all swing concentrically around the object, now successfully and extensively carried out by both Zentmayer and Gundlach, has given rise to an unusually interesting question of priority. The fact that the Rochester stands at the Centennial Exhibition, at the time of its opening, had the mirror stem hinged slightly below the plane of the object, has been not unreasonably, though incorrectly, understood by some writers to indicate that there was at that time no intention to secure fully the advantages of the concentric swing. Mr. Gundlach, however, makes a fully conclusive explanation of the apparent discrepancy. As there is no doubt that Mr. Zentmayer had then completed and made public his invention, it cannot be doubted that both parties fully matured the plan independently.

So simple a device could hardly have escaped the efforts of previous workers. It was foreshadowed in the semi-cylinder of Mr. Tolles, with its concentrically swinging shutter, and in the radial arm he has talked about for years in connection with the aperture question, and he even made, two years ago, for Dr. G. Bacon, of Boston, a stand with an "accessory carrier" swinging in this manner, but it does not seem to have been so formally published as to be available to the world or to constitute a claim to priority. In 1873 Mr. W. H. Bulloch, of Chicago, an optician who has made many excellent stands, constructed a large stand with the substage traversing around a point one tenth of an inch above the stage (to allow for thickness of object slide), but he did not combine the mirror bar with it, and does not now prefer to do so. Although his model lacked the completeness, simplicity, and facility of management of the latest forms, he came very near accomplishing the result which has since been attained, and contributed an important step in the progress toward that end. He also made, as early as 1870, a mirror bar to swing above the stage for using the mirror (without detaching it) for opaque illumination, and an identical device was employed by Spencer about the same time.[1] Similar arrangements have been used by others, to say nothing of the common expedient of mounting objectives or other illuminating contrivances on a swinging arm on the stand or on a separate base for oblique illumination at various angles which have been employed by the writer and nearly everybody else interested, ever since the subject of oblique illumination became prominent. It is, however, true that such an adjustment never came into general use as a regular part of the stand, and it is nearly equally certain that it is now so established as an important and permanent improvement.[2]

The following is Mr. Gundlach's account of his invention: —

"The construction of a stand with my now well-known fine adjustment, a modification of the glass stages used by many opticians, and finally the hanging of the mirror and other illuminating apparatus in the plane of the object, which had been already planned and announced before the close of the year 1875, was begun about the end of January, 1876, in the factory of the Bausch & Lomb Optical Company, after my arrangements with that company had been effected. In the construction of that stand I had in view the employment of a solid glass stage (not open in the centre), expecting to gain thereby the advantage of very oblique illumination, in consequence of the refraction of the surfaces.

"In order to obtain practically the optical object I had in view in placing the centre of rotation of the illuminating apparatus in the plane of the object, I had to take this refracting power of the solid glass stage into consideration, and consequently had to place the central point of rotation as much under the actual (mathematical) plane of the object, as the glass stratum of the stage would have lifted the ray.

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[1] See Table of American Students' Microscopes, by R. H. Ward, M. D., in the NATURALIST for June, 1872.

[2] The substance of this note was given in Dr. R. H. Ward's address as chairman of the microscopical sub-section of the American Association for the Advancement of Science, at the Buffalo meeting last August.

"Convinced, however, by the criticism of competent judges, and by my own observations, that the solid glass stage (without central opening) offered optical disadvantages which neutralized to a great extent the benefits that could be derived from it, I subsequently abandoned glass stages of that construction, not, however, before a number of stands had been either constructed or were in the course of construction, arranged in regard to the hinging point of the illuminating apparatus in such a manner as to suit a solid glass stage. The point selected by me for the centre of rotation of the illuminating apparatus in these stands would have been optically the correct one, if a solid glass stage of my construction had been employed.

"The stands whose construction was complete at this time, and those in process of construction, were not altered, firstly, because it would have involved considerable expense to do so, secondly, because I deemed the deviation from the actual plane of the object so slight as to be of very little consequence, especially as the actual and mathematically correct plane of the object is variable, owing to variations in thickness of the glass slides, and therefore practically unattainable for the centre of rotation, unless said centre can be made adjustable to it.

"Of these stands so made and left unaltered one was sent, with other microscope stands of our make, to the Philadelphia exhibition, and was there at the opening of the same, and the examination of this stand may have given rise to the impression that I intended to place the centre of rotation of the illuminating apparatus lower than the plane of the object. The other stands, constructed with a view of using the glass stage with central opening, and having the swinging mirror bar hinged slightly above the upper surface of the glass stage, were unfortunately not quite finished at the time the exhibition opened.

"Other stands were then in process of construction, arranged to meet the altered circumstances, and were afterwards exhibited at the Centennial Exhibition in Philadelphia, all of them conceived by me, and executed under my superintendence, before I had seen or heard of Mr. Zentmayer's efforts in the same direction."

SPENCER'S OBJECTIVES. — These celebrated lenses are now made by Charles A. Spencer and Sons, at Geneva, N. Y., and sold by G. S. Woolman, of New York. In addition to the usual first class series, and low angle series, there is an entirely new set called the students' series, of still smaller angle and very low price.

EXCHANGES. — Shell-sand from the Bermuda Islands, for any really valuable material; or selected shells from the same for mountings, of special interest. C. C. MERRIMAN, Rochester, N. Y.